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FLOOD INSURANCE STUDY

MERCER COUNTY, OHIO

UNINCORPORATED AREAS

SEPTEMBER 6, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 390392

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

MERCER COUNTY,
UNINCORPORATED AREAS,
OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Mercer County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Louisville District, (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-86-E-2226, Project Order No. 15. This study was completed in May 1987.

1.3 Coordination

Streams requiring detailed study were identified at a meeting in December 1985 attended by representatives of the Study Contractor, FEMA, and Mercer County.

On September 27, 1988, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Mercer County, Ohio. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

Flooding caused by overflow of Beaver Creek and the Wabash River was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Map for Mercer County, Ohio (Reference 1) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through May 1992. The scope and methods of study were proposed to and agreed upon by FEMA and Mercer County.

2.2 Community Description

Mercer County occupies about 444 square miles in west-central Ohio, and is bordered by Darke County, Ohio, on the south; Auglaize County, Ohio, on the east; Van Wert County, Ohio, on the north; and Jay and Adams Counties, Indiana, on the west. The City of Celina, the county seat, is in the east-central part of the county. Mercer County is served by U.S. Routes 127 and 23, State Routes 119, 219, and 707, Conrail, and the Norfolk Southern Railway. The 1980 population of Mercer County was reported to be 38,334 (Reference 2).

Of the total annual precipitation, about 20 inches usually falls in April through September, the growing season for most crops. In 2 years out of 10, the rainfall from April through September is less than 17 inches. The heaviest one-day rainfall during the period of record was 4.43 inches at Celina on September 17, 1969. Thunderstorms occur on about 41 days each year, 20 of which are in the summer. Average seasonal snowfall is 36 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 22 days have at least one inch of snow on the ground, but the number varies greatly from year to year.

Mercer County is a part of two continental watersheds. The Ohio-Erie Divide crosses the county in a general east-west direction and is partly oriented to the Wabash moraine through its central extension in the county. North of the divide, the county is mostly drained into Lake Erie by the St. Marys River and its tributaries. A few acres in northeastern Mercer County are drained by the Little Auglaize River, which flows eventually to Lake Erie. South of the Ohio-Erie Divide, the major part of the county is drained by the Wabash River and its tributaries, which flow to the Ohio River. A few acres in southeastern Mercer County are drained by Mile Creek, which flows eastward out of the county to the Ohio River.

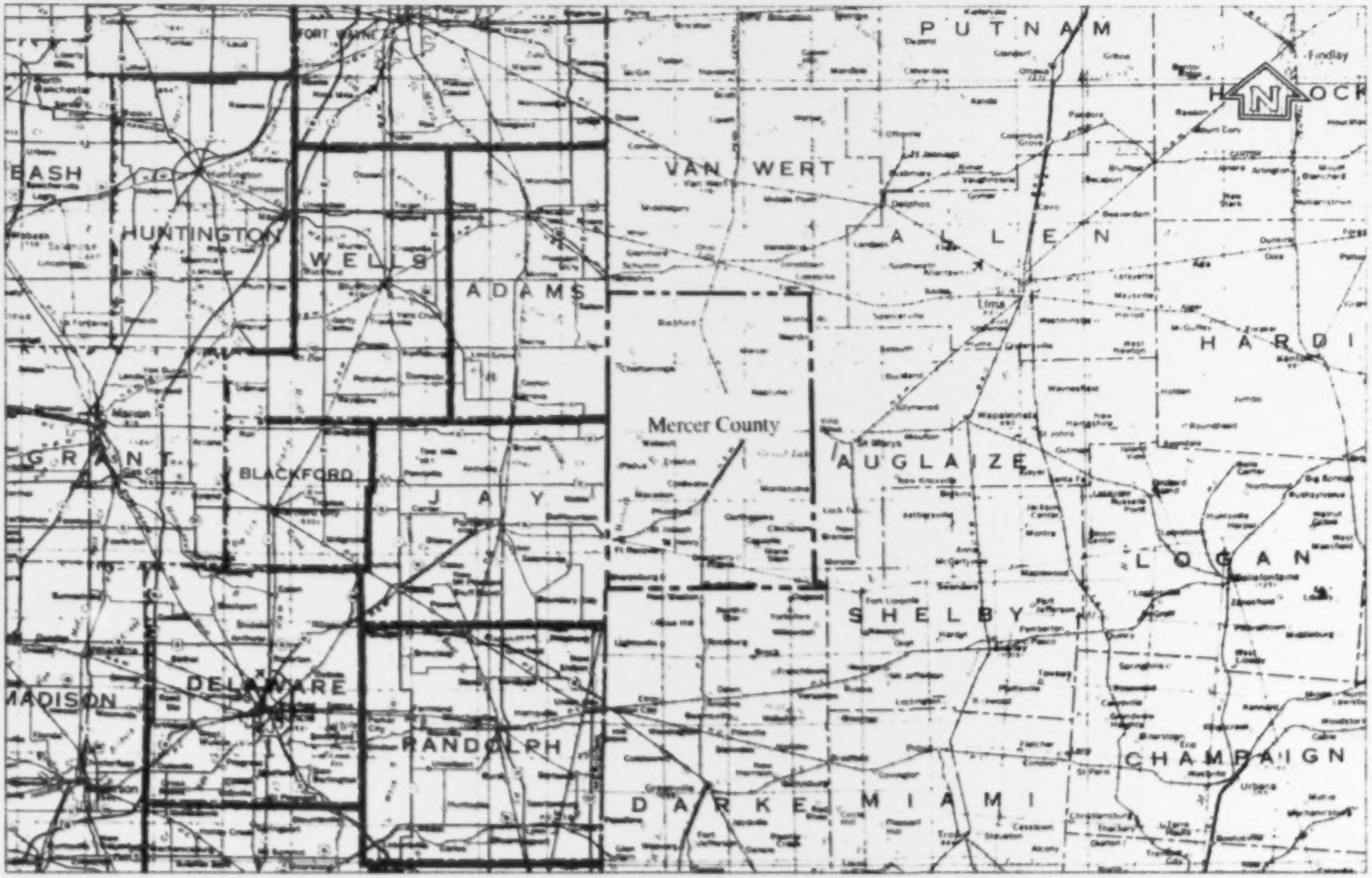


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, OH
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

13 0 13 26 39 MILES

VICINITY MAP

2.3 Principal Flood Problems

Flood problems in Mercer County are due primarily to the overflow of Beaver Creek and Grand Lake St. Marys (Reference 3). Significant problem areas are on the south shore of Grand Lake St. Marys and along Beaver Creek, the western outlet channel of the lake. Flooding on the Grand Lake St. Marys shore is caused by the inability of the 10.6-mile long westerly outlet channel to discharge sufficient flows to keep pace with inflow to the lake during peak periods. The effects of wind setup and wave runup on low-lying, developed areas also contribute to the problem.

Flood problems from Beaver Creek are caused by a combination of a limited flood control capability of Grand Lake St. Marys, poor surface drainage, low stream gradient, constrictions to flow, and high stream stages for a long period of time that cause inadequate outlet conditions for numerous artificial agricultural drains.

2.4 Flood Protection Measures

Grand Lake St. Marys is a manmade lake, two-thirds of which is in Mercer County. The lake was created by dams at each end to provide water for the Ohio-Erie Canal system. It drains to Lake Erie from the east and to the Ohio River from the west. No measurable protection from major floods such as the 100-year event is provided by this facility.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Natural frequency-discharge values for Beaver Creek, without Grand Lake St. Marys outflows, were based on analyses of data from the U.S. Geological Survey (USGS) gage station on Greenville Creek near the City of Bradford, Ohio. Analyses of additional gage stations with similar basin characteristics were compared to ensure the accuracy of regionalized values. Frequency-discharge values were then adjusted to include Grand Lake St. Marys frequency outflows based on historical lake records and present lake regulation to obtain the final values. Frequency-discharge values for the Wabash River were determined from an analysis of data from the USGS gage station on the Wabash River near the City of New Corydon.

A frequency-discharge versus drainage area relationship was developed using data from those gages and guidelines contained in Bulletin No. 17B (Reference 4). Determination of the final discharge versus drainage area relationship considered omission of low and high outliers, weighting with the generalized skew, and historical adjustment where possible.

Peak discharge-drainage area relationships for the 100-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
WABASH RIVER at 235 East Road	262.0	9,200
BEAVER CREEK at mouth	125.0	5,850

The elevation for the 100-year flood for Grand Lake St. Marys is shown in Table 2.

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATION (FEET NGVD*) 100-YEAR
GRAND LAKE ST. MARYS along shoreline	872.9

*National Geodetic Vertical Datum of 1929

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Channel and overbank cross sections were obtained from field survey and supplemented with topographic maps (Reference 5). All bridges and culverts were field surveyed to obtain elevations and structural geometry. Water-surface profiles were developed using the HEC-2 step-backwater computer model (Reference 6).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") were determined by field inspection and considered such factors as type and amount of vegetation, channel configuration, and water depth. High-water marks from the 1959 flood on Beaver Creek were reproduced in order to verify the roughness values for that stream. Roughness coefficients averaged 0.04 for the channel and 0.06 for the overbank areas.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the NGVD. Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 5).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for Mercer County (Reference 1).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways for this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 3, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
WABASH RIVER								
A	0	1811	6803	1.4	850.8	850.8	851.8	1.0
B	1.03	1700	5242	1.8	852.5	852.5	853.3	0.8
C	2.05	1360	5898	1.6	854.1	854.1	854.8	0.7
D	2.69	1553	8347	1.1	354.8	854.8	855.5	0.7
BEAVER CREEK								
E	3.07	256	1831	3.2	855.2	855.2	855.8	0.6
F	4.21	727	4994	1.1	857.8	857.8	858.7	0.9
G	5.40	725	5850	0.8	858.5	858.5	859.4	0.9
H	6.50	1106	6918	0.6	859.0	859.0	859.9	0.9
I	7.48	654	3942	0.7	859.5	859.5	860.4	0.9
J	8.63	666	4493	0.6	860.1	860.1	861.0	0.9
K	9.20	921	5913	0.4	860.3	860.3	861.2	0.9
L	10.24	578	3914	0.6	860.8	860.8	861.7	0.9
M	11.32	842	5989	0.4	861.4	861.4	862.3	0.9
N	12.44	1059	6739	0.1	861.5	861.5	862.4	0.9
O	13.16	93[2]	853	2.0	861.6	861.6	862.6	1.0

[1]MILES ABOVE COUNTY BOUNDARY
[2]THIS WIDTH EXTENDS WITHIN AREA NOT INCLUDED

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

WABASH RIVER / BEAVER CREEK

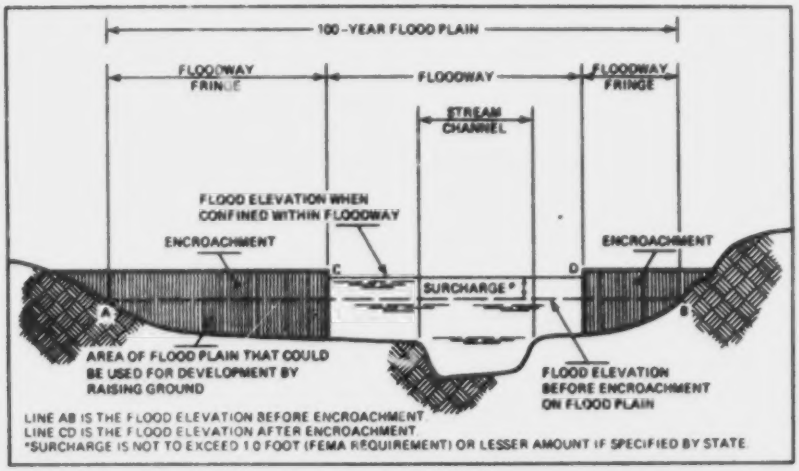

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Flood Insurance Study published for Adams County, Indiana (Reference 7) and Flood Insurance Rate Maps printed for the Villages of Rockford and Fort Recovery, the City of Celina, and Van Wert County, Ohio (References 8-11) are in agreement with this study.

Flood Insurance Studies in progress for Auglaize County and Darke County, Ohio (References 12 and 13) are in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Mercer County (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604-2698.

9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Mercer County, Unincorporated Areas, Ohio, July 1977.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Ohio, Washington, D.C., February 1982.

3. U.S. Army Corps of Engineers, Grand Lake St. Marys, Ohio, Survey Report for Flood Control and Allied Purposes, August 1981.

4. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

5. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 5 Feet: Celina, Ohio, 1960; Erastus, Ohio, 1960; and New Corydon, Indiana-Ohio, 1960.

6. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

7. Federal Emergency Management Agency, Flood Insurance Study, Adams County, Unincorporated Areas, Indiana, August 1981.

8. ————, Flood Insurance Rate Map, Village of Rockford, Mercer County, Ohio, February 1986.

9. ————, Flood Insurance Rate Map, Village of Fort Recovery, Mercer County, Ohio, May 1987.

10. ————, Flood Insurance Rate Map, City of Celina, Mercer County, Ohio, March 1986.

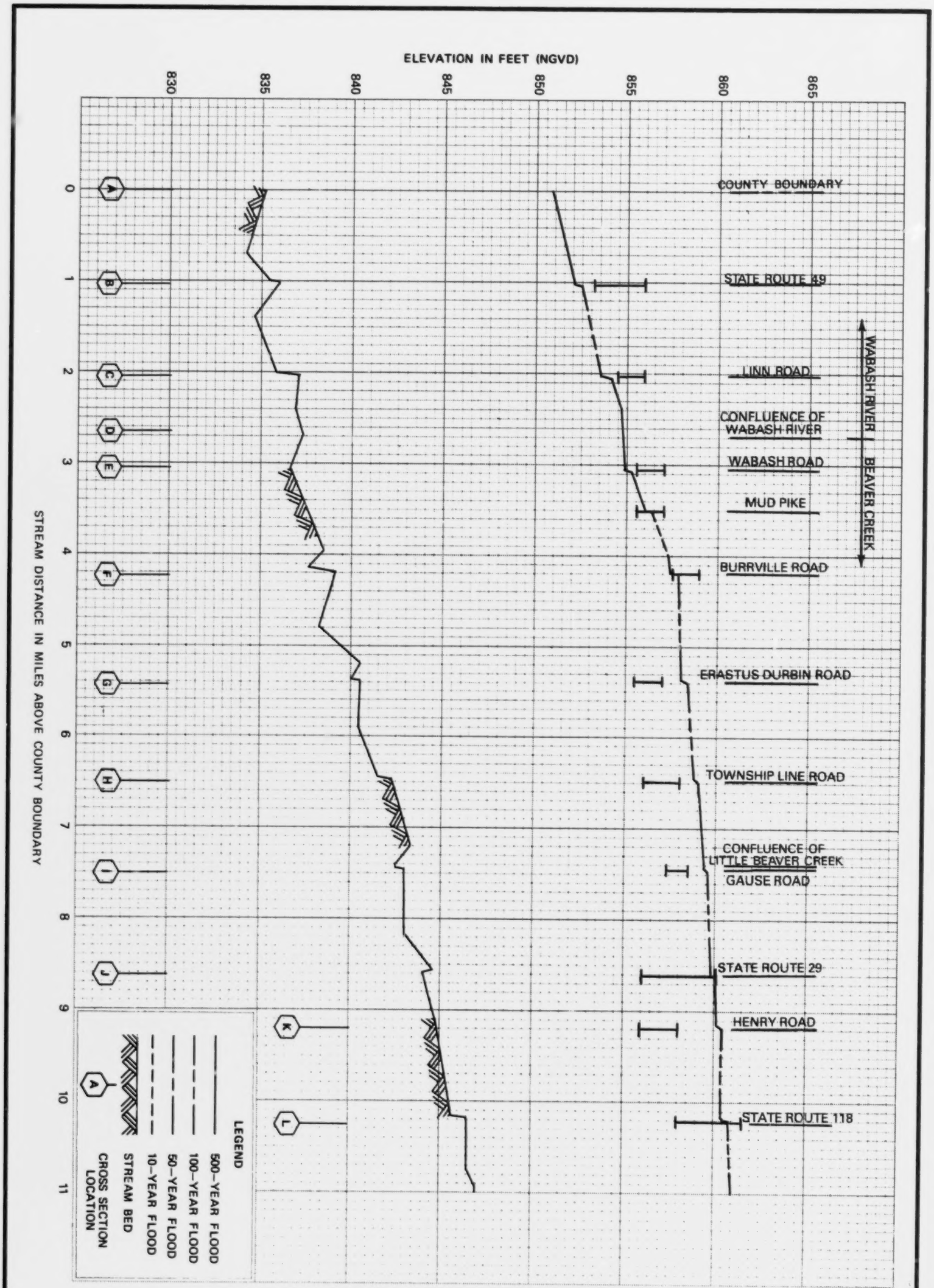
11. ————, Flood Insurance Rate Map, Van Wert County, Unincorporated Areas, Ohio, September 1987.

12. ————, Flood Insurance Study, Auglaize County, Unincorporated Areas, Ohio, in progress.

13. ————, Flood Insurance Study, Darke County, Unincorporated Areas, Ohio, in progress.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0075	854.155	U.S. Coast and Geodetic Survey disk set in top of concrete post located 51 feet west of centerline of State Route 49 near intersection of Carmel Church Road
2	0075	859.878	bronze State Department of Highways disk set in concrete post located at southwest corner of tee intersection of State Route 49 and Doner Road
3	0075	854.523	U.S. Coast and Geodetic Survey disk set in top of concrete post located 33 feet south of centerline of State Route 29, about 350 feet west of intersection of State Route 29 and Erastus Durbin Road
4	0075	856.317	U.S. Coast and Geodetic Survey disk set in top of north end of west abutment of small concrete bridge located on State Route 29 about 165 feet west of intersection of Gause Road and State Route 29
5	0100	856.973	U.S. Coast and Geodetic Survey disk set in top of northwest wingwall of 96-inch concrete pipe culvert located about 330 feet west of intersection of State Route 29 and State Route 118
6	0100	862.951	U.S. Coast and Geodetic Survey disk set in top of west end of north headwall of concrete culvert located at intersection of State Route 29 and Fleetfoot Road
7	0100	871.360	U.S. Coast and Geodetic Survey disk set in top of concrete post located at intersection of State Route 29 and Meyer Road



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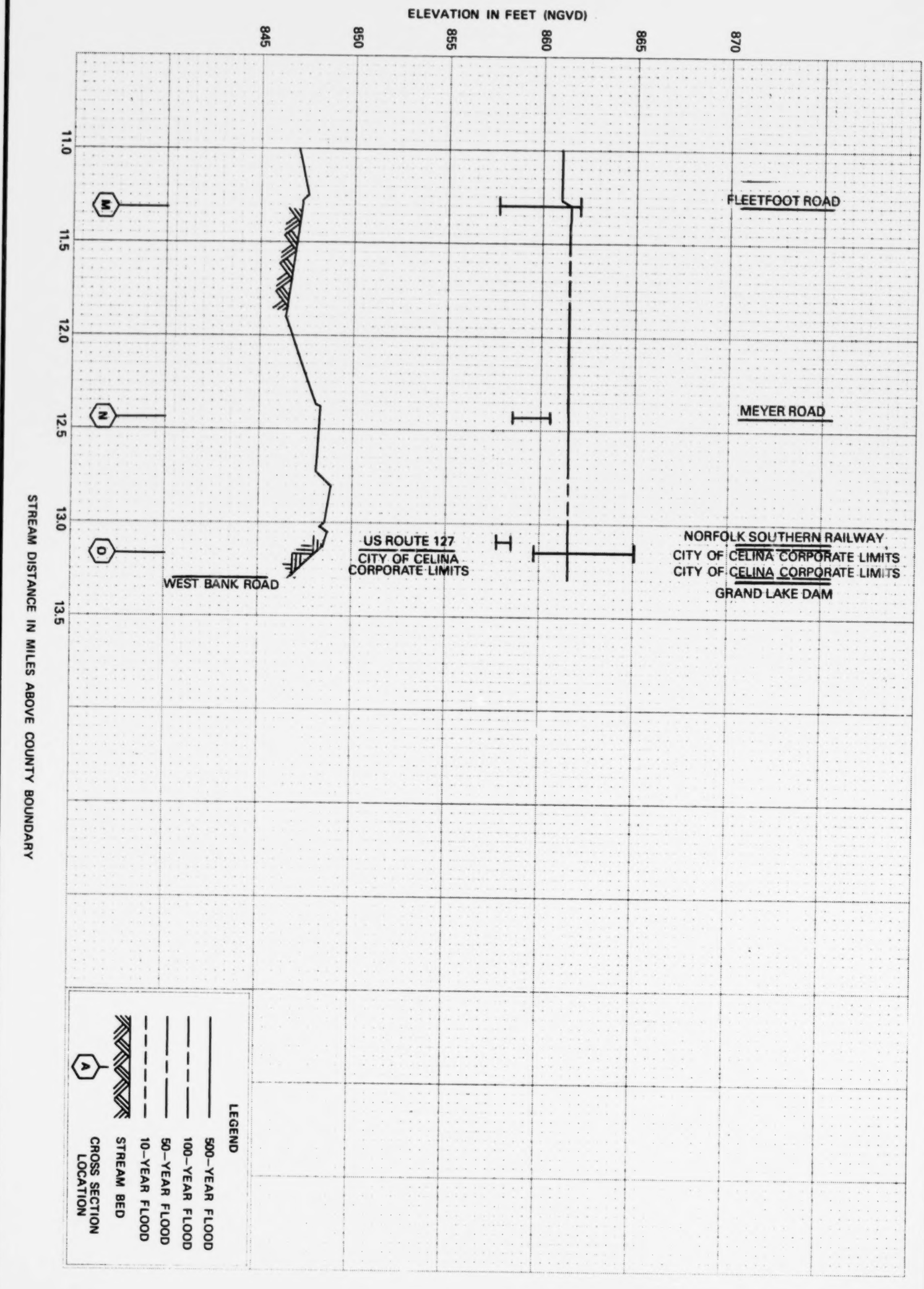
01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **MERCER COUNTY, OH** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **WABASH RIVER / BEAVER CREEK**



02P	FEDERAL EMERGENCY MANAGEMENT AGENCY **MERCER COUNTY, OH** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **BEAVER CREEK**